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the characters must be determined; (2) geographic probabilities must be utilized; (3) similarities and intergradations must be sought."

As a result the 43 forms (20 species and 23 subspecies) recognized by Cope in his posthumous work "The Crocodilians, Lizards, and Snakes of North America" (Rep. Smiths. Inst., 1898), are reduced to nineteen; and of the twenty-two names given by Cope eighteen appear only as synonyms. Nearly seventy names have been conferred on these nineteen forms, or an average of three and a half for each.

Dr. A. E. Brown, the last preceding reviser of the group, in his "Review of the Genera and Species of American Snakes, north of Mexico," published in 1901,⁶ reduced the number of forms to eighteen—ten species and eight subspecies; he proceeding on somewhat the same lines as Ruthven, namely, "that a knowledge of the laws under which forms are developed is to be best gained by a study of variations." While the number of forms admitted by the two authors is practically the same, the taxonomic results are widely diverse.

Dr. Ruthven believes that the garter-snakes will be found to furnish excellent material for experimental research, as they are hardly in captivity, and prolific; and that the first problems to be attacked are the inheritability of scale characters and the influence of inbreeding and unfavorable conditions of food and temperature. But it is to be remembered that experimental research must necessarily be conducted under unnatural conditions, and that the results do not necessarily show what has taken place under natural environments. While the results thus obtained are always interesting and suggestive, they can not be looked upon as conclusive respecting what has actually occurred under natural conditions.

J. A. A.

LEPIDOPTERA

Hybrid Lepidoptera.—Although published more than a year ago, Mr. J. W. Tutt's account of hybridization and mongrelization in Lepidoptera is probably scarcely known to evolutionists in this country. The two chapters in which he sums up and discusses all that is known on these subjects are prefaced to a much larger work, the first volume of the "Natural History of the British

⁶ *Proc. Acad. Nat. Sci. Phila.*, 1901, pp. 10-110.

Alucitides." The book, a large volume of 558 pages, is part of Mr. Tutt's exhaustive "Natural History of the British Lepidoptera," this particular volume dealing with the plume moths. The treatment of the several species is even more exhaustive than that given by Mr. Scudder in his great work on the butterflies of New England; and as in Scudder's work, the purely taxonomic details are relieved by chapters on general topics.

In his two chapters, Mr. Tutt enumerates all the recorded crosses between different species (hybrids) and between different forms of the same species (mongrels), and gives numerous particulars about them. At the end of the book is an appendix describing other cases made known while the volume was in press. It appears that about 90 hybrid Lepidoptera are known, these being especially numerous among the Attacides and Anthrocerides. The well-established hybrids have been reared in captivity, and it is justly argued that many alleged hybrids found at large must be regarded with extreme suspicion, as being quite probably merely variations of one of the supposed parents. The most distantly related species which have, when crossed, produced fertile eggs and subsequent larvæ, are *Saturnia pavonia* \times *Graellsia isabellæ*; but in this case the larvæ could not be raised to imagines. There is a very interesting discussion of the question whether hybridization is capable of giving rise to new species in a state of nature. This is considered extremely unlikely, for the following reasons:

"Even when hybridity is not difficult to procure between two species, the progeny shows little fertility *inter se*, and, although the males are more frequently fertile with females of either of the parent species, the female hybrids are much more rarely fertile with the males of the parent species, and at present few hybrids show comparatively free fertility *inter se*. This appears to be largely due to the anatomical and morphological upset in the sexual organs of the female hybrids, an upset that frequently finds its outward recognition in the development of gynandromorphic forms, in which the primary sexual characters are often considerably modified, and correspondingly marked changes take place in the secondary sexual characters.

"Assuming, however, hybridity ever to take place in nature, the hybrids themselves will often, presumably, follow one or other of the parent forms so far as relates to its habits, time of appearance, etc., and the chance of a male and female hybrid,

assuming that some of both sexes get through successfully, then meeting each other, as against the possibility of either meeting and pairing with or being paired with a male or female of the much more abundant parent form, is so remote that one puts aside the possibility."

The instances of mongrelization are classified under the following headings:

1. Crossing of typical form and local race.
2. Crossing of typical form and aberration; production of artificial races by inbreeding.
3. Crossing of typical forms with aberrations tending to develop melanochoic races.
4. Crossing of typical form with aberration trying to set up local race.
5. Crossing of dimorphic forms of a species which occur together and rarely appear to attempt to supplant each other.
6. Crossing of typical forms with possible constitutional aberrations.
7. Dimorphism in one sex.

It is impossible to give any summary of the many cases described under these headings, but enough has been said to show how valuable the work is to students of evolution and variation.

T. D. A. COCKERELL.

PARASITOLOGY

Parasitic Diseases in the Philippines.—The paramount importance of zoonotic diseases in the Philippines may be judged from the recently published record of the bureau of health since the medical work at Bilibid Prison was placed under its charge in November, 1905. The prevailing diseases treated in Hospital A, Bilibid Prison, were hookworm, 1,537 cases; amebic dysentery, 551 cases; acute dysentery, 174 cases; cholera, 18 cases; pneumonia, 62 cases; beriberi, 60 cases; conjunctivitis, 221 cases, and malaria, 174 cases; 81 per cent. were thus due to animal parasites. The death rate decreased from 238 per thousand in 1905 to 13.5 per thousand in June, 1907. General sanitary measures were responsible for the first reduction to about 75 per thousand; active measures against animal parasites led to the further reduction.